

System Specification

GSE and Gateway Common Services Completion Thread, Thor DP1

Checkout and Launch Control System (CLCS)

84K00302-007

Ground Support Equipment and Gateway Common Services Completion Thread Assessment

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1. Introduction

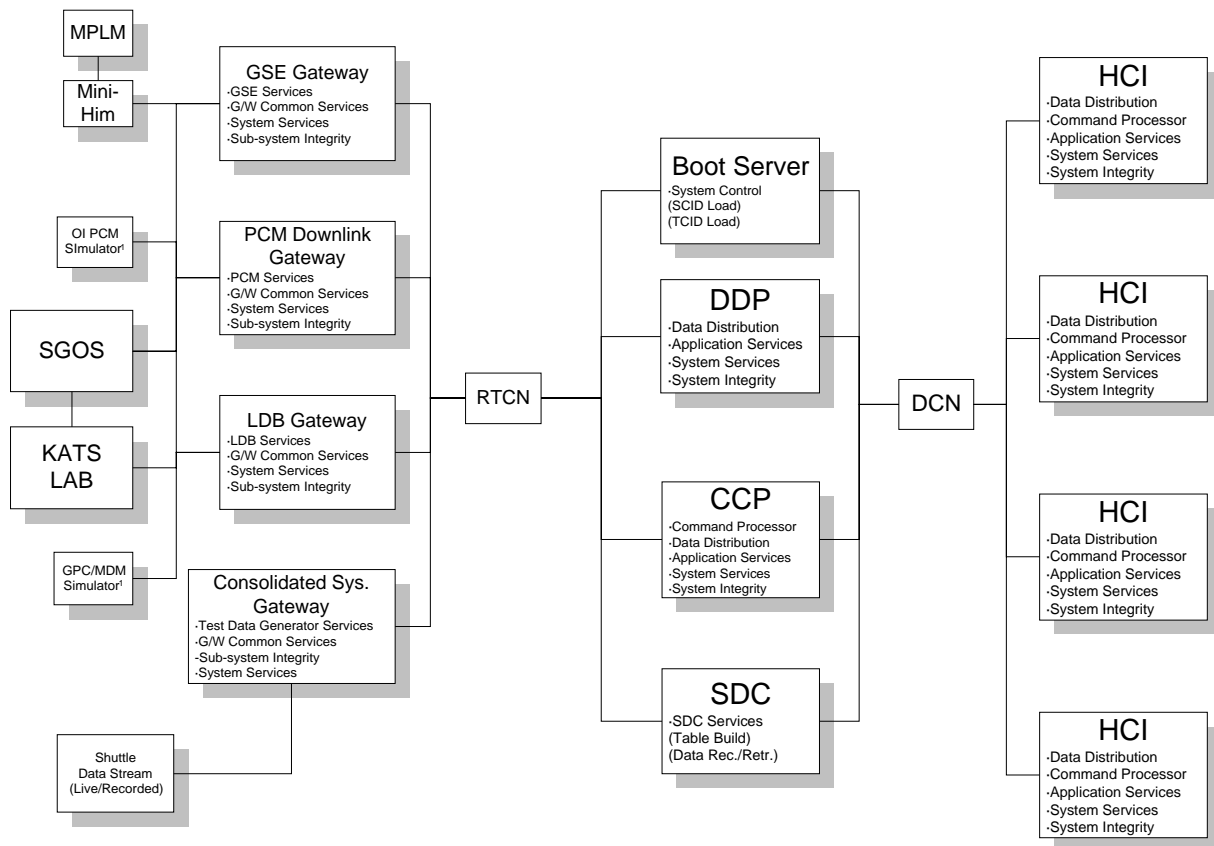
1.1 Ground Support Equipment (GSE) and Gateway Common Services Completion Thread

This thread provides a fully functional Ground Support Equipment (GSE) Gateway. This is needed to allow deployment to the Hypergolic Maintenance Facility in the Atlas delivery. Addition will be needed later in the project to support system integrity, redundancy management, and special data handling. These will be covered in a redundancy thread.

1.2 GSE and Gateway Common Services Completion Thread Concept

To provide Phase 1 GSE Support requires support from the GSE Gateway and all other major CLCS Systems.

Ground Support Equipment and Gateway Common Services Completion Thread Concept Diagram



1. Gateway Team developed test tools

1.3 GSE and Gateway Common Services Completion Thread Specification

1.3.1 Statement of Work

- Provide the application services required to support all Ground Support Equipment FD's.

- Add support for Table Maintenance Function.
- Add support for changing poll rates.
- Add support for enabling and disabling processing of selected FD's.
- Add support for enabling and disabling collection and distribution of all samples of selected FD's.
- Add support for modification of Calibration and Engineering Units of selected FD's.
- Add support for generation of Ground Support Equipment Gateway Status FD's.
- Add support for checkpoint (*Not Supported for Thor*)
- Add support for health packet and sub-system integrity data.
- Build, load, distribute, and initialize all TCID table and SCID software require to support Ground Support Equipment operation.

1.3.2 Requirements

SLS Requirements addressed in this thread:

- (SLS - 2.1.1.6) Ground Data Bus Interface

The Ground Data Bus (GDB) communicates with Hardware Interface Modules (HIM) located at various locations around KSC to monitor and control Ground Support Equipment (GSE) and facilities . There are two types of HIMs, the original CCMS HIMs, plus new HIM-IIs scheduled for installation in FY97/98. The HIM-IIs implement a 44-bit protocol in addition to the original HIM 28-bit protocol to allow higher resolution analog input cards to be used. The protocol is selectable at the HIM, but only a single protocol may be active on any given GDB at a time.

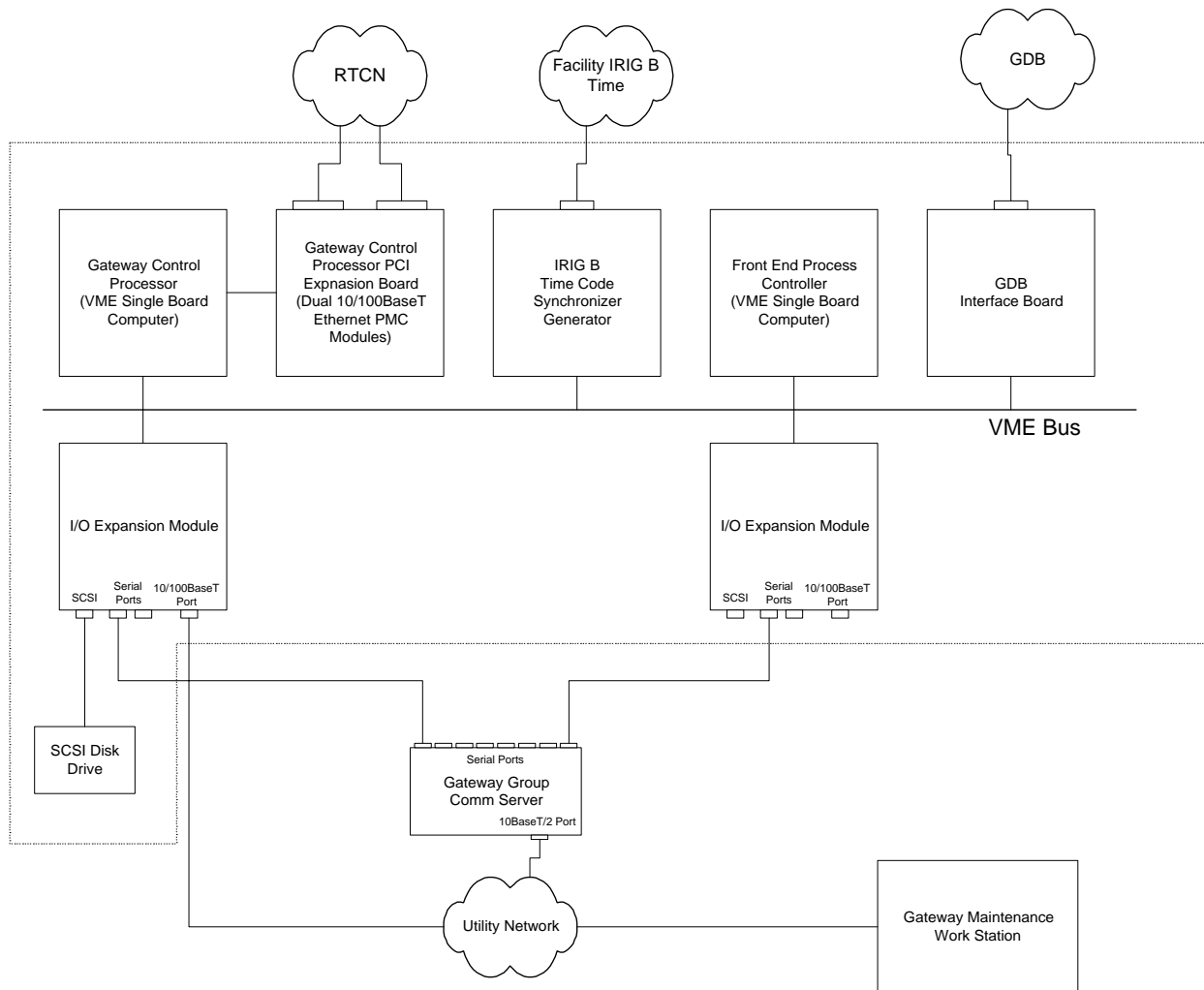
The Ground Data Bus is a burst-mode, bi-directional, full-duplex, asynchronous 1 Mbs Manchester II data bus. The HIM uses a 28-bit packet (GSE Type-I) with 100 usec spacing between packets, while the HIM-II is also capable of utilizing a 44-bit packet structure (GSE Type-II). At the interface to the RTPS Gateway, the electrical signal is a differential 2 VP-P +/- 0.2 VP-P at 124 Ohms balanced.

(Note: HIM-II (44 Bit) support will not be supported for Thor)

- (SLS - 2.1.1.6.1) The RTPS ground data bus shall receive and process measurement data and issue commands to both the CCMS Hardware Interface Module (HIM), and the replacement HIM-II.
(Note: HIM-II support will not be supported for Thor)
- (SLS - 2.1.1.6.2) The RTPS shall interface using the GSE Type-I Data Bus (28-bit) with the HIM/HIM-II via the protocol described in:
CP90IT0916 CCMS HIM End Item Specification
- (SLS - 2.1.1.6.4) The RTPS shall support up to, and including, sixteen (16) HIM/HIM-IIs per ground data bus.
- (SLS - 2.1.1.6.6) The RTPS shall support up to, and including, to sixteen (16) HIM/HIM-IIs per RTPS Gateway.
- (SLS - 2.2.2.2.1) All gateways shall be able to support full link bandwidth with all values changing every sample.
- (SLS - 2.2.2.2.2) RTPS shall be able to support full Uplink command rates on the following links:
GSE - 500/second.
- (SLS - 2.2.2.2.5) All subsystems acquiring data from external Ground Support Equipment shall be synchronized to Range Time to within 10 microseconds to support 100 microsecond measurement time-stamping.

1.4 GSE and Gateway Common Services Completion Thread Hardware Diagram

The following diagram illustrates the major hardware elements in the GSE Gateway. The hardware elements enclosed by the dashed line reside in the Gateway VME Chassis.



1.5 GSE and Gateway Common Services Completion Thread Deliverables

Software:

Deliverable	R&D Document	Code	API Manual	Users Guide
Gateway Common Services CSCI	X	X		
GSE Services CSCI	X	X		

Hardware:

Deliverable	R&D Document	Drawings	Prototype	Users Guide
GSE Gateway SDE-1			1	
GSE Gateway SDE-2			1	
GSE Gateway IDE-1			1	
GSE Gateways HMF			4	
Maintenance Work Station			1	

1.6 GSE and Gateway Common Services Completion Thread Assessment Summary

This section contains the summary of the costs and labor involved in implementing the Ground Support Equipment and Gateway Common Services Completion Thread capability. It is broken into three sections. The first is a summary of the individual CI (CSCI and HWCI) labor assessments. The second is a summary of hardware costs. The third is a summary of procurement activities needed.

1.6.1 Labor Assessments

The total Labor Costs required to provide this capability are summarized in the following table;

Example:

No.	CSCI/HWCI Name	Thor LM	Changes covered in
1	GSE Services CSCI	6 .0	Ground Support Equipment and Gateway Common Services Completion Thread
2	GDB/LDB Interface Board HWCI	2.0	Ground Support Equipment and Gateway Common Services Completion Thread
3	Gateway Control Processor/Front End Processor Controller HWCI	1.0	Ground Support Equipment and Gateway Common Services Completion Thread
4	Gateway IRIG-B Interface Board HWCI	1.0	Ground Support Equipment and Gateway Common Services Completion Thread
5	GCP Common Services CSCI	15	Ground Support Equipment and Gateway Common Services Completion Thread
6	Test Build & Control	3.0	Ground Support Equipment and Gateway Common Services Completion Thread
7	System Services CSCI (System Control CSC)		System Services Enhancement Thread
8	Command Support CSCI		Commanding and Command Processor Phase 2 Thread
9	Data Distribution		Data Distribution Completion Thread
10	System Services		
11	Application Services		Data Distribution Completion Thread/ Commanding and Command Processor Phase 2 Thread
12	System Viewer		System Viewers Thread
13	Data Recording/Archival and Retrieval		Log, Record and Retrieval Phase 1 Thread
	TOTAL	28.0 LM	

1.6.2 Hardware Costs

All GSE hardware to support development efforts in the SDE 1, SDE 2, and IDE 1 is currently on hand or already on order.

1.6.3 Procurements

LDB/GDB Interface Board evaluation is planned for Thor. The procurement costs associated with this effort are included in the Launch Data Bus Interface Phase 1 Thread.

1.7 GSE and Gateway Common Services Completion Thread Schedule & Dependencies

1.7.1 Schedule

Task Name	Start	Finish
Thor Assessment Kickoff	9/8/97	9/8/97
Concept Panel Internal Review	9/23/97	9/23/97
Concept Panel	9/25/97	9/25/97
Thor Development		
GSE Services CSCI Requirement Panel Internal Review	11/4/97	11/4/97
GSE Services CSCI Requirement Panel	11/6/97	11/6/97
GSE Services CSCI Design Panel Internal Review	11/4/97	11/4/97
GSE Services CSCI Design Panel	11/6/97	11/6/97
Gateway Common Services CSCI Requirement Panel Internal Review	11/4/97	11/4/97
Gateway Common Services CSCI Requirement Panel	11/6/97	11/6/97
Gateway Common Services CSCI Design Panel Internal Review	11/4/97	11/4/97
Gateway Common Services CSCI Design Panel	11/6/97	11/6/97
Gateway Common/GSE Services CSCI Unit Testing	1/2/97	1/16/97
Gateway Common/GSE Services CSCI Development Integration Test	1/19/97	1/16/97
Gateway Common/GSE Services CSCI Formal Integration Test	2/16/97	2/20/97
Support System Integration Test	2/23/98	3/27/97
Thor Development Complete	3/27/97	3/27/97

1.7.2 Dependencies

No.	Dependency Area	Dependency	Need Date
1	Test Build and Control	GSE Tables	12/12/97
2	Gateway O/S	VxWorks SENS Release (IP Multicast Support)	11/1/97

1.8 GSE and Gateway Common Services Completion Thread Simulation Requirements

The Ground Support Equipment and Gateway Common Services Completion Thread will utilize the existing LPS Simulation System with the math models for HMF and other GSE. The GSE Gateways in SDE 1 and SDE 2 will be connected to the VSIs in the LCC via the PCC RCVS and the GSE Gateway in the IDE 1 will be connected to the VSIs via the VSI T/R System. All simulations will be conducted in the real-time mode.

1.9 GSE and Gateway Common Services Completion Thread Integration and System Test

Ground Support Equipment and Gateway Common Services Completion Thread testing is composed of two major activities:

- Common Gateway Services CSCI/GSE Services CSCI will utilize Gateway Test Tools (Change Data Packet Analyzer/CCP Simulator) for development and formal CSCI Integration Testing. A network analyzer may also be used to verify packet structure, data content and timing information.
- System Integration and Test will develop a test plan and test procedures to verify end to end data flow through the system

1.10 Ground GSE and Gateway Common Services Completion Thread Training Requirements

None.

1.11 GSE and Gateway Common Services Completion Thread Facilities Requirements

None.

1.12 GSE and Gateway Common Services Completion Thread Travel Requirements

This section contains a list of travel requirements. If there are none, the section should state none.

Example:

From	To	Reason	No. People	Duration	Est. Date or Frequency
KSC	JPL	VxWorks Software development Information Exchange	3	3 Days	TBD

1.13 GSE and Gateway Common Services Completion Thread Action Items/Resolution

See issues listed in individual CSCI assessments.

2. Ground Support Equipment and Gateway Common Services Completion Thread CSCI Assessments

2.1 Common Gateway Services CSCI Assessment

Common Gateway Services CSCI provides functionality that is utilized by all Gateways. This CSCI will be revised in order to comply with the other CLCS capabilities available at the Thor Release. The Redstone release established the basic functionality of Common Gateway Services. The Thor delivery will expand upon that base to include primarily Health and Status, Error Logging, and the Maintenance User Interface.

Gateway Initialization CSC Work Required

- Update the VxWorks kernel to accommodate any changes in Gateway hardware or VxWorks software releases.
- Provide functions to access and update Non-volatile RAM for Reference Designators, etc.
- Provide the capability to respond to the Activate/Inhibit Data Acquisition Initialization commands.
- Implement the Gateway Primitive Mode.

Gateway Command and Response CSC Work Required

- Update Command and Response code to accommodate any changes in the C to C command and response formats.
- Provide the capability to generate a “command issued” response which returns a time-out value for those commands that need an extended period of time to execute.

Gateway RTCN Utilities CSC Work Required

- Update RTCN Utilities code to accommodate any changes in the Change Data Packet format.
- Provide an RTCN stream and associated functions to receive Block Funnel Log data from the Gateway processors and route it to the recorder.

Gateway Timer Services CSC Work Required

Timer Services will not undergo any major changes.

Gateway Health and Status CSC Work Required

- Provide the capability to report task -level and board-level health and status via the RTCN Change Data stream.
- Provide usage counter utilities to track Gateway statistics (e.g. Change Data Packets per second).

Gateway Utility Request CSC Work Required

- Development of a Gateway Recovery Dump utility which will dump all Gateway software information in the case of a fatal error.
- Development of Error logging utilities that will support all processors in the Gateway.
- Provide the capability to send and receive System Event codes.

Gateway Maintenance User Interface CSC Work Required

- Development of a Maintenance User Interface Server which will run on the Gateway and provide an operator with all health and status information, usage statistics, and Gateway specific information (e.g. accessing GSE error counts).
- Development of a Maintenance User Interface Client which will be host independent and will be capable of “logging in” on the Gateway to access Gateway information.

Gateway Software Diagnostics CSC Work Required

Future release.

Gateway Redundancy Management CSC Work Required

Future release.

Gateway Control Processor (GCP) Services API CSC Work Required

- Provide a Block Funnel Log equivalent function to send archive data to the RTCN Utilities CSC.

Gateway Test Tools CSC Work Required

- Development of a Function Designator Tracking Utility that will receive Change Data Packets from the RTCN, and parse out and display occurrences of a user-specified Function Designator.

CSCI Assessment

CSC Name	CSC Labor (LM)	% of CSC
Gateway Initialization CSC	0.75	10
Gateway Command and Response CSC	0.25	5
Gateway RTCN Services CSC	1.0	10
Gateway Timer Services CSC	0	0
Gateway Health and Status CSC	5.0	50
Gateway Utility Request CSC	1.5	50
Gateway Maintenance User Interface CSC	5.0	50
Gateway Software Diagnostics CSC	0	0
Gateway Redundancy Management CSC	0	0
GCP Services API CSC	0.25	5
Gateway Test Tools CSC	1.25	25
Totals (Thor Only)	15	

Basis of estimate

Estimate is based on the work required for Redstone deliverables and the time taken to complete that work. The labor required for the Thor deliverables is an extension of the Work Completed in Redstone.

Documentation

GSE Gateway Operations Procedure will be developed.

Assumptions

None.

Open Issues

Issue 1: Will Reliable Messaging be required for streams issuing packets at the System Synchronous Rate?

Issue 2: Will Reliable Messaging streams allow multiple senders for Thor?

Issue 3: Will the Gateway need to respond to an on-demand poll for Health and Status?

Issue 4: Will the Gateway provide all necessary Health and Status via status FDs?

2.2 GSE Services CSCI Assessment

The Thor delivery of the GSE Gateway Services CSC will essentially complete work on this CSCI with the following four exceptions:

- Redundancy/Switchover
- Type II HIM functionality
- CITE fuel cell simulation capability
- Use of the SBS card set for the HIM Ground Data Bus interface

Command Processor CSC Work Required

Decode route code and request ID's for all new commands defined by Thor.

HIM Hardware Test CSC Work Required

This CSC is new for Thor.

Incorporate CCMS HIM test functionality

Incorporate CCMS switch scan functionality

Execute the following new C-to-C commands:

- Activate/Inhibit HIM test
- Activate/Inhibit HIM test on an FDID

- Activate/Inhibit HIM test on a HIM

Initialization CSC Work Required

Execute the following new C-to-C commands:

- Activate/Inhibit Data Acquisition
- Activate/Inhibit Global Command Issuance

Issue Command CSC Work Required

Modify response format for Issue, Set and Apply commands.

Execute the following new C-to-C commands:

- Read analog
- Read discrete
- Read digital pattern
- Determine HIM presence

Measurement Processing CSC Work Required

Make use of a measurement processing task that is common across all gateway types. Incorporate any changes required for new change data packet format.

Subsystem Integrity CSC Work Required

This CSC is new for Thor

- Provide a mechanism for looking up the FDID's for all health/status FDs
- Provide task health/status.
- Provide hardware health/status.
- Provide GSE subsystem health/status.
- Provide utilization counters.

Table Load CSC Work Required

- Modify table contents to accommodate common measurement processing task.
- Perform table verification at load.

Table Maintenance CSC Work Required

This CSC is new for Thor.

Execute the following new C-to-C commands:

- Change EUP
- Read EUP
- Inhibit table update functions
- Activate/Inhibit FD command issuance
- Activate/Inhibit FD polling
- Activate/Inhibit data processing
- Activate/Inhibit processing all
- Activate/Inhibit HIM polling
- Change hardware address
- Change sample rate
- Status FD

GSE Services CSCI Assessment

CSC Name	CSC Labor (LM)	% of CSC
Command Processor	0.50	95
HIM Hardware Test	1.00	95
Initialization	0.50	95
Issue Command	0.50	95
Measurement Processing	0.50	95
Subsystem Integrity	1.50	25
Table Load	0.50	95
Table Maintenance	1.00	95
Total (Thor only)	6	

Basis of estimate

Estimate is based on the work required for Redstone deliverables and the time taken to complete that work. The labor required for the Thor deliverables is a an extension of the work completed in Redstone.

Documentation

GSE Gateway Operations Procedure will be developed.

Assumptions

The health/status interface will implemented using FD's which are output using the already defined change data interface.

Open Issues

none

2.3 Test Build and Control Assessment

The Test Build and Control CSCI will complete support for the GSE Gateway.

CSC CLCS Gateway Table Build Work Required

The Gateway Table Build Software will be modified as required to support this thread. These changes will include for the packing of discretes with the highest sample rate FD, the deletion of some null fields, and include additional information in the tables (e.g. LPC Designation, Gateway Name, TCID Name).

Basis of estimate

CSC Name	CSC Labor (LM)	% of CSC
Gateway Table Build	3 LM	10%

Documentation

Document Type	New/Update	Number of Pages
Requirements and Design Documentation	Update	TBD
Users Guide	N/A	N/A
API Interface Document	N/A	N/A

Document Type	New/Update	Number of Pages
Interface Design Document	N/A	N/A
Test Procedure	Update	TBD

Assumptions

None

Open Issues

None

3. GSE and Gateway Common Services Completion Thread HWC Assessments

None. (MIC/MTC Card set will be utilized for Thor).

4. COTS Products Dependencies

4.1 SW Products Dependency List

Product Name	Quantity Needed	Need Date
VxWorks SENS Release	1	11/1/97

4.2 HW Products Dependency List

Product Name	Quantity Needed	Need Date
SPANS PCI Expansion Modules	3	10/17/97
100BaseT PMC Modules	6	10/1/97
SCSI Disk Drives	3	10/1/97
MVME 2604 SBC w/ 761 Module	3	10/1/97